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## Annual Report – FY 2002

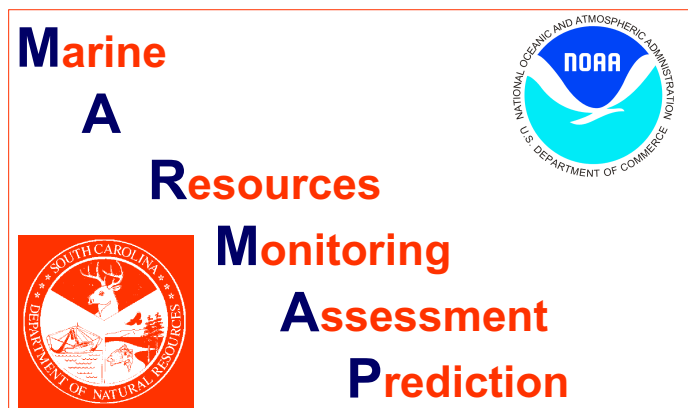
A summary of monitoring and tagging work by the Marine Resources Monitoring and Assessment Program at Gray's Reef National Marine Sanctuary during 2002.

Submitted to:

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## *Introduction*

The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) program has conducted research on reef fish between Cape Lookout, NC, and Cape Canaveral, FL, for 30 years. Sponsored by National Marine Fisheries Service (NMFS), the program mission has been to determine the distribution, relative abundance, and critical habitat of the economically and ecologically important fishes of the South Atlantic Bight and relate these to environmental factors and exploitation activities.

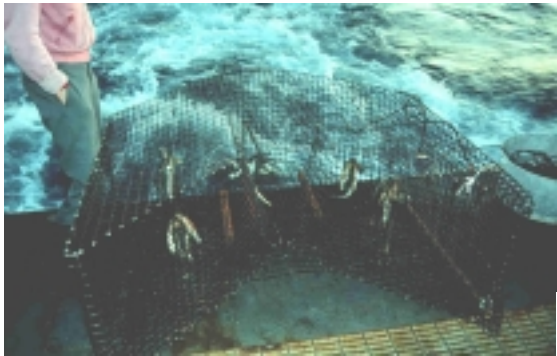
During 1993-1995, the MARMAP program monitored black sea bass abundance and conduct tagging work to assess the status of fish populations within the Gray's Reef National Marine Sanctuary (GRNMS). No sampling was conducted during 1996 and 1997. We continued monitoring work in 1998 and tagging in 1999.

In August 2002, stations at Grays Reef National Marine Sanctuary were again included in the MARMAP data base and sampled in a non-destructive fashion during MARMAP's reef fish survey. In November 2002, population abundance of black sea bass, *Centropristis striata*, in GRNMS was quantified by tag and recapture and deployment of standard chevron traps in an effort to continue efforts that were initiated during 1993 to assess the status of fish populations.

During August 02 and November 02 our objectives were to:

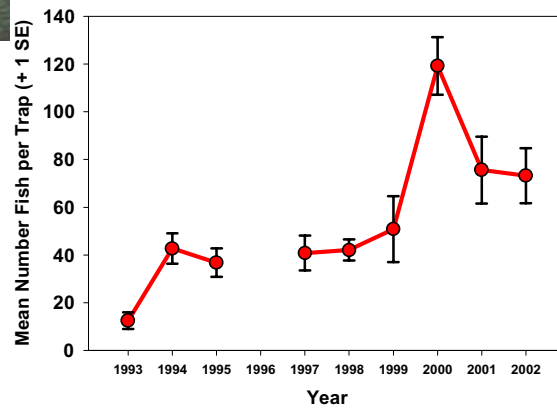
1. Conduct routine MARMAP reef fish sampling in GRNMS to assess species composition and length-frequency parameters.
2. Compare results from GRNMS to similar habitats that are routinely sampled by MARMAP.
3. Tag fishes within the sanctuary to monitor movements.
4. Conduct a population study of black sea bass via the Petersen method and compare results to those of 1993-1995 and 1999-2001.
5. Use tagging and length frequency data to estimate fishing mortality at GRNMS.

## Conduct routine MARMAP reef fish sampling in GRNMS to assess species composition and length-frequency parameters.



temperature were measured with a CTD. All fishes were sorted to species, weighed and measured to the nearest cm and returned alive to the water. Twelve species were caught in the chevron traps during August 2002. Catches were numerically dominated by black sea bass (67%), scup (18%), pinfish (8%), and tomte (3%). The remaining 4% of the catch included blue runner, gray triggerfish, northern puffer, greater amberjack, pigfish, spottail pinfish, planehead filefish and leopard toadfish.

During July 1993-1995, July 1998-2001, and August 2002, chevron-shaped wire fish traps (Collins 1990) baited with cut clupeids were deployed at randomly selected reef stations in GRNMS and soaked for approximately 90 minutes. After each trap set, depth, salinity, and

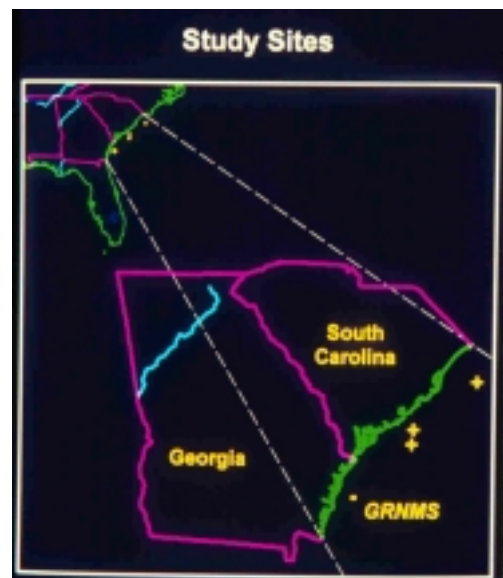


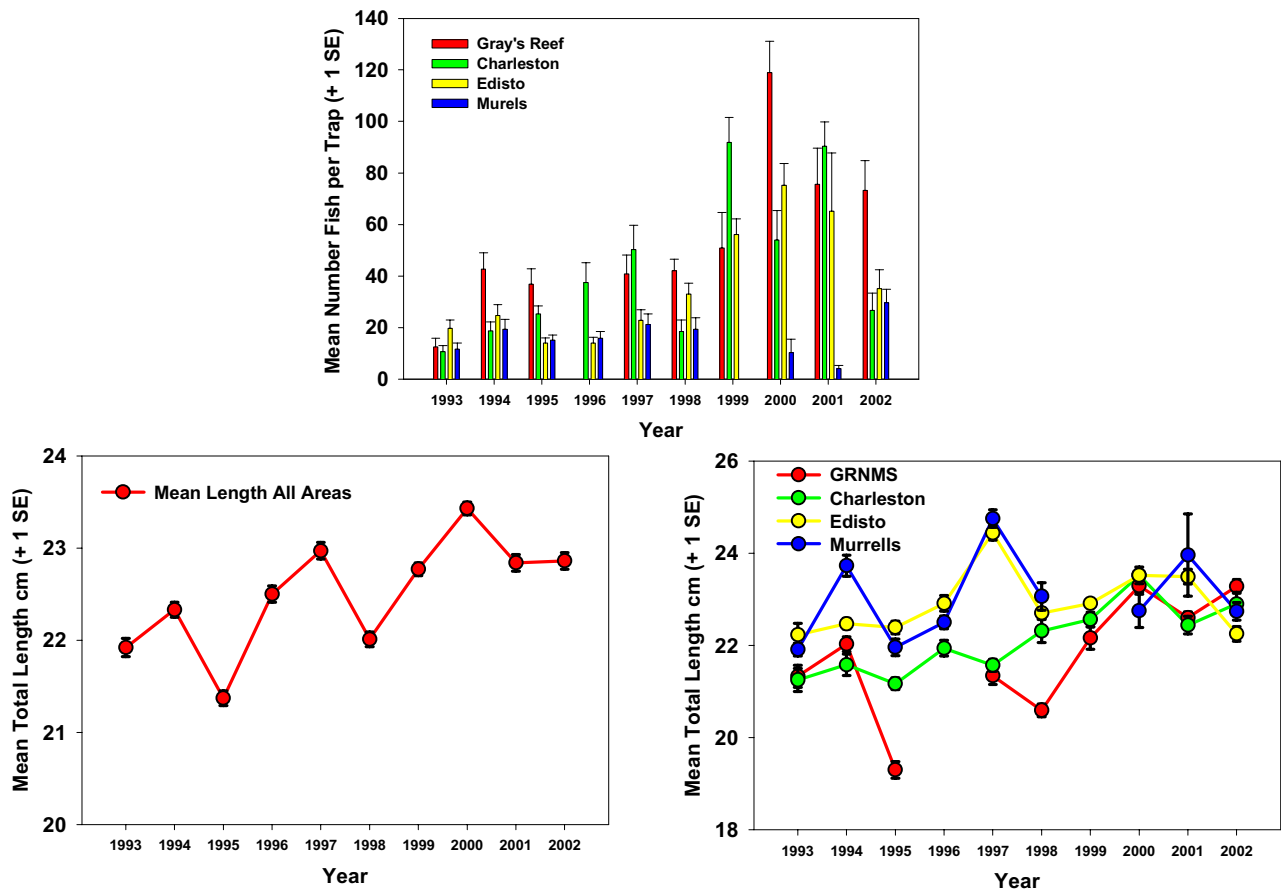
The average number of black sea bass caught per trap has increased since 1993 with a tremendous jump occurring during 2000. The number of black sea bass caught per trap decreased from an average of 119 fish in 2000 to 76 fish during 2001 and 73 fish during 2002.

## Compare results from GRNMS to similar habitats that are routinely sampled by MARMAP.

The average number of fish caught per trap and mean total length (TL) of black sea bass were compared to other study sites off Charleston (18 m; 32° 30' N, 79° 41' W), Edisto Island (26 m; 32° 16' N, 79° 43' W and Murrell's Inlet (26 m; 33° 16' N, 78° 26' W) that are similar in depth to GRNMS.

Relative abundance of black sea bass at GRNMS, Charleston and Edisto was much greater during 1999-2001 than during 1993-1998. However, there was a substantial decline in

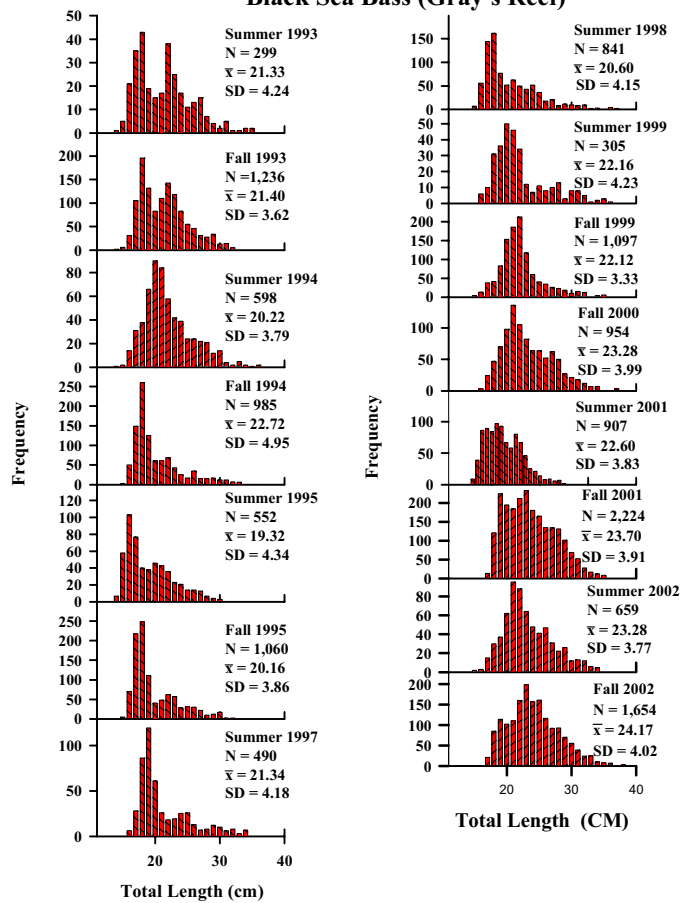




abundance at the Charleston and Edisto sites during 2002. Abundance of black sea bass at GRNMS was much greater during 2002 than the other sites that are similar in depth.

The mean length of black sea bass at all sites has gradually increased from 21.9 cm in 1993 to 23.4 cm TL in 2000 with a decrease to 22.8 cm in 2001 and 2002. Like other locations, the mean length of black sea bass taken at Gray's Reef has gradually increased from 21.3 cm TL in 1993 to 23.3 cm TL during 2000 and 2002. The mean length of black sea bass taken at GRNMS and the Charleston site which are both 18 m deep was usually smaller than mean length of black sea bass sampled at the 26 m sites (Edisto and Murrells), however, there was little difference in the mean length during 1999, 2000 or 2002. We did not sample GRNMS in 1996 or off Murrells Inlet during 1999. The mean length of black sea bass at Grays Reef was greatest during 2000 and 2002.

# Black Sea Bass (Gray's Reef)



Length frequency plots of black sea bass caught with chevron trap during summer and fall of 1993 to 2001 revealed that there was a substantial increase in the number of larger fish caught by trapping gear in recent years than during 1993-1995. Furthermore, larger fish were more frequently caught during fall in 2001 and 2002 than during the summer.

## Tag fishes within the sanctuary to monitor movements.



During Summer 1993, Fall 1993-1995, and Fall 1999-2002 fishes of commercial and recreational importance were measured to the nearest mm and tagged at GRNMS. Numbered plastic internal anchor tags were inserted (usually on the left side of the body) anterodorsal to the anus. The tags had external streamers with printed information that was identical to the anchor. During the six years, a total of 11,494 black sea bass were tagged at GRNMS. There were 861 fish recaptured through MARMAP sampling and recreational fishermen recaptured 230 fish.

Of the 230 fish recaptured by recreational fishermen, 16 (7%) were recaptured outside of GRNMS. Seven moved fairly large distances. Five were recaptured off Jacksonville, FL (111 km); one was recaptured off St. Augustine (167 km), and two have moved to the Charleston site (160 km). The remaining individuals moved between 34 and 56 km to live bottom areas surrounding GRNMS like the Savannah Snapper Banks.

Ten of the fish that were recaptured outside of Gray's Reef were tagged during 1999 - 2001. The average size of black sea bass recaptured by recreational fishermen was larger (287 mm TL) than the mean size of all black sea bass that were recaptured (266 mm TL). It is likely that larger fish exhibit more movement. With the increase in the mean size of black sea bass, it may be that there is more movement away from Gray's Reef than occurred during 1993-1995.



In 1993, 832 black sea bass were also tagged at J-Reef. Three of 20 recaptured black sea bass tagged at J Reef moved to other locations.

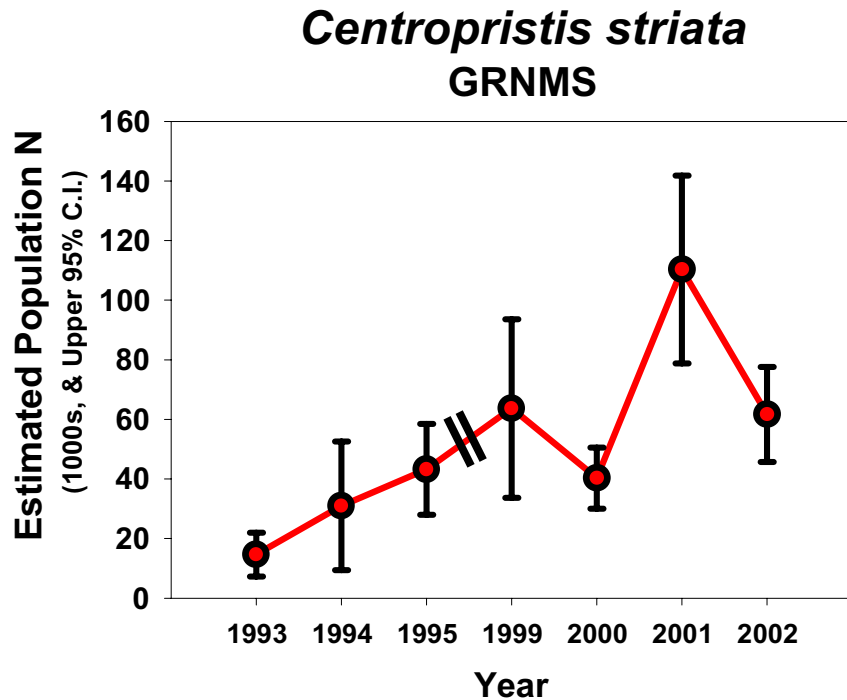
## Conduct a population study of black sea bass via the Petersen method and compare results to those of 1993-1995 and 1999-2000.

A Petersen mark recapture experiment was conducted each fall from 1993-1995 and again during 1999-2002. The large area of GRNMS (5,822 ha) prohibited a tagging study of the whole Sanctuary. Therefore, a study was conducted in a small isolated reef area (480 ha) within GRNMS. Previous work indicated that



the area was bounded by sand on two sides and low to moderate relief on the other two sides. Due to the large number of black sea bass caught in traps during the last few years, the previous study area used during 1993-1995 was divided in half. The number of black sea bass determined from the population study was doubled so that comparisons could be made to previous years. On 4-5 November 2002, a total of 1,358 black sea bass were tagged, 1,655 were examined

for tags during day 2, and 72 tagged individuals were recovered. The Petersen method provided an estimate of 61,658 individuals in the original study area. Estimated abundance of black sea bass at GRNMS showed a tremendous increase from 1993 to 2001 followed by a decrease in 2002.



### **Use tagging and length frequency data to estimate fishing mortality at GRNMS.**

Total mortality (Z) was estimated by linear regression from the slope of the natural logarithm of the age frequency that was fully recruited to trapping gear. An age length key was applied to the lengths of fish collected to determine the age frequency of black sea bass. Natural mortality (M) was estimated to be 0.30 from the equation  $M = 2.98/\text{maximum age}$  (Hoenig 1983).

Table 1. Fishing mortality determined by catch curve analysis for black sea caught with trapping gear at GRNMS (summer and fall), Charleston, Edisto, Murrells and all other sites sampled by MARMAP during 1993-2002.

<b>Year</b>	<b>GRNMS (Summer)</b>	<b>GRNMS (Fall)</b>	<b>Charleston</b>	<b>Edisto</b>	<b>Murrells</b>	<b>Other Sites</b>
<b>1993</b>	1.27	1.85	1.36	1.33	1.10	1.07
<b>1994</b>	1.33	1.51	1.10	1.13	1.48	0.98
<b>1995</b>	1.74	1.66	1.47	1.13	1.05	1.20
<b>1996</b>	-	-	1.55	1.15	1.47	1.00
<b>1997</b>	1.64	-	1.34	0.92	1.31	1.01
<b>1998</b>	1.23	-	1.15	1.05	1.39	1.05
<b>1999</b>	1.16	1.34	1.24	1.05	-	1.10
<b>2000</b>	-	1.22	1.19	1.13	1.00	1.03
<b>2001</b>	1.46	1.29	1.36	1.21	1.58	1.12
<b>2002</b>	1.77	1.43	1.10	1.29	1.32	1.18

At GRNMS, fishing mortality was lower during summer 1998-1999 than summer 1993-1995. In addition, fishing mortality during fall 1999-2001 was much lower than during fall 1993-1995. A decline in fishing mortality was also observed at most of the other sites sampled. During 2002, there was a substantial increase in fishing mortality at GRNMS. Fishing mortality was generally higher at GRNMS than at Edisto, Charleston, or Murrells especially in 2002.

Total mortality ( $Z$ ) was also obtained from tag recaptures reported by recreational fishermen by the equation:  $Z_i = -(\log_e R_2 - \log_e R_1)$  where  $R_1$  = the number of fish that were recaptured six months (through April) following a tagging event in October of year  $i$  and  $R_2$  = the number of fish that were recaptured after April following October tagging in year  $i$ .

Table 2. Fishing mortality determined by catch curve analysis at GRNMS (summer and fall) and tag recapture information during 1993-1995 and 1999-2002.

<b>Year</b>	<b>GRNMS (Summer)</b>	<b>GRNMS (Fall)</b>	<b>Tagging</b>
<b>1993</b>	1.27	1.85	1.20
<b>1994</b>	1.33	1.51	1.40
<b>1995</b>	1.74	1.66	1.77
<b>1999</b>	1.16	1.34	1.62
<b>2000</b>	-	1.22	1.39
<b>2001</b>	1.46	1.29	0.39
<b>2002</b>	1.77	1.43	-

With the exception of 2001, estimates of fishing mortality determined from recapture data were similar to estimates determined from catch curve analysis. Fishing mortality could not be determined for 2002 because not enough time has passed for fishermen to report tags.